Information on the Earth Information Day

Note by the Chair of the SBSTA

13 November 2019

I. Introduction

1. The Earth Information Day will take place on Tuesday 3 December 2019, in conjunction with the meeting of the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its fifty-first session, during the Climate Change Conference (COP 25), Madrid, Spain.

2. The first Earth Information Day took place on 8 November 2016 at COP 22.[1] Subsequently, the SBSTA invited submissions from Parties to consider inviting the secretariat to organise similar events.

3. The Earth Information Day was mandated at SBSTA 50,[2] to be held at SBSTA 51 and future sessions where systematic observation is considered. The SBSTA recognized that the Earth Information Day could be a valuable opportunity for exchanging information on the state of the global climate system and developments in systematic observation. Its organisation is guided by previous mandates on systematic observation and submissions.[3]

4. This note provides an overview of the Earth Information Day to be held at SBSTA 51, including information on its organization and themes (section II), background information on activities under the Convention (III) and activities by relevant programmes and organizations (section IV).

5. All information on the Earth Information Day at SBSTA 51 is available on a dedicated website which will be updated regularly.[4] Following the event, I will prepare a summary report, which will be made available before SBSTA 52.

II. Organisation and themes

6. The Earth Information Day will take place in two sessions on **Tuesday 3 December 2019**:

(a) **Plenary session (10:00–13:00)** with presentations and discussions.

(b) **Poster session (13:15–15:00)** allowing a one-to-one dialogue between the experts, Parties and observers.

7. Responding to mandates and submissions, I have identified three themes:

(a) **Updates on the State of the global climate**;

(b) **Updates on implementing Earth observation: for region and country support, and needs**;

(c) **Earth observation for science, policy and practice: retooling global cooperation to respond to future climate risk**.

8. I have proposed guiding questions for each of the themes above (see box 1 below) that are intended to help to focus presentations and discussions.

9. I plan to chair the dialogue and invite representatives from Parties, the observation and observation-user communities to participate. This will include on theme 1 representatives from the WMO and IPCC, and on theme 2 representatives from GCOS; the Joint CEOS/CGMS Working Group on Climate and UNESCO-IOC. On theme 3, I will invite Steven Ramage from GEO to chair a panel discussion on this theme with representatives including from ECMWF/Copernicus Progamme, Japan Agency for Marine-Earth Science and Technology, Confederation of Indigenous Organizations of the Amazon Basin and Party representatives.

10. The secretariat will prepare a detailed agenda for the Earth Information Day that will be available from the event webpage. The event will be also available via webcast. I encourage participants to make use of social media to share the discussion with a wider community (Twitter hashtag #EarthInformationDay) and use sli.do to ask questions during the event.

[1] See https://unfccc.int/topics/science/events-meetings/systematic-observation/earth-information-day-2019.
[2] FCCC/SBSTA/2019/2, paragraph 58.
[3] Available at https://www4.unfccc.int/sites/submissionsstaging/Pages/Home.aspx and https://unfccc.int/node/289819.
[4] See https://unfccc.int/topics/science/events-meetings/systematic-observation/earth-information-day-2019.

11. I invite Parties to come prepared to participate actively in the Earth Information Day. It is important that this event be an active dialogue in which parties and other users of information have an opportunity to express their needs and exchange with those programmes and systems that are providing it.

12. The information and discussions presented during the Earth Information Day may be used to inform negotiations under agenda item 7(b) during SBSTA 51. I also encourage Parties to use the information in those discussions to inform their continued activities on systematic observation to support work under the Paris Agreement and Convention.

Box 1 **Themes and guiding questions**
1. Updates on the State of the global climate
What is the latest knowledge on the state of the global climate? What is the latest knowledge on the impacts of climate change and associated projected risks?
2. Updates on implementing Earth observation: for region and country support, and needs
What is the current status on the implementation of the GCOS implementation plan, including monitoring, reporting and quality control of all essential climate variables in oceanic, terrestrial and atmospheric domains? How are the needs of countries and regions with limited observation network coverage in particular being addressed by ongoing developments to maintain, access and/or improve long term data record? What are the needs to support NDCs, national inventories and the global stocktake that new capabilities for Earth observation can support?
3. Earth observation for science, policy and practice: retooling global cooperation to respond to future climate risk
What is the role and value of Earth observations in supporting the implementation of the Paris Agreement? How can decision-making be supported by advances in using earth observation data for improving and validating earth systems models, including for near-term climate projections? How do we ensure universal equitable coverage of, and open-access to, (big) data and information?

III. Background information – activities under the Convention

13. This section provides an update on some of the relevant ongoing activities under the Convention.

14. The **eleventh meeting of the research dialogue: Science for Transformation** was held on 20 June 2019. The summary report is available online.[5]

15. The **Stakeholder Engagement Workshop on Strengthening the Capacities for Observation and Risk Assessment in the Context of Loss and Damage associated with Climate Change Impacts**, 29–30 October 2019, Bonn, Germany, was convened in response to the strategic work plan 4(c) of the five-year rolling workplan of the Executive Committee of the Warsaw International Mechanisms for Loss and Damage associated Climate Change Impacts.[6] It explored ways to facilitate capacity-building for enhanced observation and risk assessment, particularly developing countries and vulnerable communities to avert, minimize and address loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events. The workshop also identified ways for relevant organizations and agencies to cooperate and implement comprehensive risk management approaches.[7]

16. The **Nairobi work programme current focus is oceans, coastal areas and ecosystems**, including mega deltas, coral reefs and mangroves as well as slow onset events, in areas of understanding and assessing climate change impacts as well as resilience and adaptation to climate change. The aim is to identify data and knowledge gaps, reporting back to SBSTA 52, to support countries undertake meaningful scaled up adaptation action. The focal point forum in conjunction with SBSTA 51, 6 December 2019, will advance this thematic area further.[8]

[5] See https://unfccc.int/topics/science/workstreams/research/research-dialogue/eleventh-meeting-of-the-research-dialogue-science-for-transformation.
[6] See https://unfccc.int/sites/default/files/resource/Detailed%20workplan%20by%20strategic%20workstreams.pdf.
[7] See https://unfccc.int/node/200542.
[8] See https://unfccc.int/node/200545.

IV. Background information – activities by programmes and organizations

17. This section provides an update on some of the relevant ongoing activities by the systematic observation community. It is a non-exhaustive list that aims to provide an overview according to programme / organization in alphabetical order.

Committee on Earth Observation Satellites and the Coordination Group for Meteorological Satellites

18. The **web-based Inventory of existing and planned climate data records of GCOS Essential Climate Variables (ECV) observable from space** is updated annually and currently contains information for approximately 1300 datasets.[9] The 2019 version, to be published by the end of 2019, fills previously identified gaps. Space agencies have started to address data records for lightning, sea-surface salinity, above ground biomass, and permafrost, the latter two having significance for the study and analysis of the Earth's carbon cycle. The Joint CEOS/CGMS Working Group on Climate continuously analyses the Inventory and space agencies use this resource to inform their planning for both mission and product generation to pre-empt measurement gaps in Earth observation in the future. The 2019 analysis focused on ECVs for which GCOS has identified issues in their long-term provision, thus providing substantial input to the 4th GCOS status report in 2021.

19. CEOS and CGMS agencies continue to **coordinate annual global coverage of the world's forested areas** to ensure the necessary data in support of national reporting processes of the Global Forest Observations Initiative (GFOI), and the Global Observation of Forest Cover and Land Dynamics (GOFC-GOLD) effort. The CEOS Working Group on Capacity Building and Data Democracy (WGCapD), along with GOFC-GOLD and GFOI are providing regional training in coordination with national agencies on the use of these data. In 2019, CEOS began to coordinate the use of multiple satellite missions with novel capabilities to derive above ground biomass. These data offer new prospects and will enable more direct estimates in support of forest and carbon emission reporting – including for global stocktakes.

20. Based on a whitepaper endorsed by CEOS and CGMS in 2019,[10] CEOS and CGMS have **developed a roadmap to implement an operational atmospheric CO_2 and CH_4 monitoring system in several steps to maximize contributions to the Transparency Framework and the achievement of Nationally Determined Contributions and for stocktaking**. The first prototype system is based on available space-based assets and could inform the first global stocktake in 2023. A pre-operational system should support the second global stocktake in 2028. CEOS and CGMS welcome Parties, and their technical agencies, to start engaging with CEOS and CGMS agencies prior to the first stocktake to ensure that the products and services provided are fit-for-purpose.

Copernicus Climate Change Service

21. The Copernicus Climate Change Service (C3S),[11] implemented by the European Centre for Medium-range Weather Forecasts (ECMWF) on behalf of the European Union, supports society by **providing authoritative information about the past, present and future climate in Europe and the rest of the World**. It relies on state-of-the-art research carried out by the scientific community, for example within the World Climate Research Programme (WCRP).

22. Its wide portfolio includes Earth Observation based climate information (historical climate data records of a wide variety of ECVs, earth-system reanalyses), multi-model seasonal forecasts, climate projections and scenarios, and climate impact indicators in many economic sectors.

23. Although focussed over Europe, **a wide range of these products are global**, and progressively C3S has become an invaluable operational resource to support the Global Framework for Climate Services (GFCS), inform the WMO annual State of the Climate, and respond to the user requirements defined by the Global Climate Observing System (GCOS).

24. To achieve this, a **one-stop-shop Climate Data Store**[12] has been implemented, and proactive support and training actions have been undertaken to support the Community, such as participation in the National Adaptation Plans Expo 2019 and the UN SG Climate Action Summit.

25. Further to the Climate Change Service (C3S), other Copernicus services, such as the Marine Environment Monitoring or Land Monitoring, provide information products relevant for climate change policies.

[9] See https://climatemonitoring.info/ecvinventory/.
[10] See http://ceos.org/document_management/Virtual_Constellations/ACC/Documents/CEOS_AC-VC_GHG_White_Paper_Publication_Draft2_20181111.pdf.
[11] See https://climate.copernicus.eu/.
[12] See https://cds.climate.copernicus.eu/.

Group on Earth Observations

26. The **GEO Work Programme 2020–2022**[13] **comprises 58 activities** encompassing Earth observations in agriculture, forestry, land use, water, biodiversity and other areas that are relevant to GEO's engagement priorities, namely the Paris Agreement, the Sendai Framework for Disaster Risk Reduction and the UN 2030 Agenda for Sustainable Development. GEO has been aiming to develop an integrated mechanism for coordination of climate matters across its Work Programme. To that end, a Climate Coordinator has been appointed at the GEO Secretariat since September 2019. A Climate Working Group is also being established, which would be mandated to develop and implement an overall GEO climate strategy to advance the use of Earth observations in support of climate action.

27. To better serve Earth observation user communities, the ever-evolving **GEOSS Platform incorporates new and customisable instruments and services, as part of the continuous improvement of the GEOSS**.[14] To go towards a results-oriented GEOSS and enhance reproducibility of the knowledge produced by the Work Programme activities, a proof of concept for the GEO Knowledge Hub was presented at the GEO Week 2019, in Canberra, November 2019. The GEO Knowledge Hub is a digital library based on open source solutions that will allow users to discover, access and reuse EO solutions in an organized and curated way.

28. GEO has promoted key global and regional initiatives to support decision making on climate, including with the use of big data. Launched in August 2019, **Digital Earth Africa** (DE Africa)[15] delivers the capability to store, manage, process, interrogate, and present Earth observation data as decision-ready products, building on the Open Data Cube technology originally developed in Australia. DE Africa will provide a routine, reliable and operational decision support service. In December 2018, GEO and Amazon Web Services (AWS) announced the **Earth Observation Cloud Credits Programme**, a collaboration to offer GEO members and research organizations access to AWS Cloud services to help countries realize the potential of Earth observations for sustainable development. In June 2019, the GEO Secretariat announced 21 projects from 17 developing countries that would be awarded USD 1.5 million worth of cloud services through this Programme.[16] In September 2019, GEO has launched an open call for platform providers to lower the barriers to entry to technology for developing countries.[17]

Global Climate Observing System

29. GCOS identifies and establishes observation requirements for monitoring **54 ECVs** that, together, give a complete view of the state of the climate system in all three domains: atmospheric, terrestrial and ocean.

30. The status of observations is monitored and made available on the internet through WMO, IOC and the Joint CEOS/CGMS WGClimate[18]. GCOS will produce an overview of the **status of global observing system for climate in 2021** and, review and publish the actions needed to address the gaps and deficiencies identified in a **revised implementation plan in 2022**.

31. In regards to **atmospheric observations**, the GCOS surface and upper air networks are monitored[19] by GCOS and WMO with the assistance of Germany[20] and Japan.[21] In the WMO Integrated Global Observing System (WIGOS) context, WMO is keeping track of Platforms making systematic observations through its OSCAR Database.[22] Compliance of these observing stations with WMO Technical Regulations is monitored through the WIGOS Data Quality Monitoring System (WDQMS).[23]

32. A series of **regional workshops** have been held with WMO's WIGOS and in collaboration with the UNFCCC in regions with poor reporting of atmospheric observations: in the Pacific Islands (2017), East Africa (2018) and, most recently the GCOS/WIGOS Caribbean Workshop on Observations for Climate and Meteorology, in Belize 10–12 July 2019. The key messages from the GCOS/WIGOS Caribbean Workshop on Observations for Climate and Meteorology are identified in Box 2.

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13 See https://www.earthobservations.org/geoss_wp.php.
14 See https://www.geoportal.org/.
15 See https://www.digitalearthafrica.org.
16 See http://earthobservations.org/article.php?id=362#awarded_projects.
17 See https://www.earthobservations.org/documents/calls/GEO_CommercialSector_CloudServices.pdf.
18 For atmospheric observations see https://gcos.wmo.int/en/networks and for ocean observations see http://www.jcommops.org/board.
19 See https://gcos.wmo.int/en/networks/atmospheric.
20 Deutscher Wetterdienst (DWD), Global Climate Observing System Surface Network Monitoring Centre https://www.dwd.de/EN/climate_environment/climatemonitoring/climatedatacenter/gsnmc/gsnmc_themen_node.html.
21 Japan Meteorological Agency (JMA) http://ds.data.jma.go.jp/tcc/tcc/products/climate/climatview/frame.php.
22 See https://oscar.wmo.int.
23 See http://wdqms.wmo.int/wdqms.

33. Outcomes from all the three workshops held so far showed that the costs of sustained, systematic, observations are too expensive for many countries while all countries benefit from these observations. Therefore, WMO developed the Global Basic Observing System (GBON) that will provide the minimum data needed to support global numerical weather prediction and climate models, forecasts and projections.[24]

34. In recognition of the outcomes of the workshops, WMO is developing the **Systematic Observations Financing Facility** that would both support the development of the basic network where there are gaps and also support its ongoing operation. GBON would cost USD 750 million by 2025 and lesser amounts thereafter.

Box 2
Key messages from the GCOS/WIGOS Caribbean Workshop on Observations for Climate and Meteorology

OBSERVATION

- The value of basic observation systems cannot be over-emphasized - Terrestrial and radiosonde observations (e.g. WIGOS/GBON) are an important part of the GCOS Implementation Plan. Putting the data into international systems leads to increased accuracy of weather and climate models which, in turn, leads to improved forecasting and climate services.
- Sustainability of observations, following the GCOS monitoring principles, is required to support climate monitoring and climate-change decision making. The most important need is to support unbroken long-term data acquisition not new systems. Maintaining, strengthening, upgrading, and improving existing systems is needed (e.g. supplying spare parts): Mostly issues that are relatively low cost.

TRAINING

- Needed for staff to interpret the meteorological information to provide climate services, e.g. on agriculture, extreme events. Training is also needed to support the underlying observations especially covering GBON and associated IT.
- Year-long fellowships have been successful and should be supported and encouraged.

WIGOS

- WIGOS is developing GBON to meet the global monitoring needs for climate and weather. Regional WIGOS centres are needed to support the regional development of WIGOS & GBON. In the Caribbean region the regional WIGOS Centre will need to be setup, with appropriate funding, to support GBON site identification, data entry, calibration, training, procurement, IT etc.

FUNDING

- From all 3 GCOS regional workshops (S. Pacific, E. Africa and Caribbean) it is clear that project funding from international donors does NOT work for sustainable, systematic observation of the climate. Piecemeal funding has caused a range of issues for effective operation and has not established sustainable long-term operation.
- There is a need for an alternative model of funding, one good example in the Caribbean is the long-term funding of radiosonde operation by the US.
- Observations for any region in the World supports national weather and climate predictions for all countries. Funding should reflect this global benefit.

[24] See https://www.wmo.int/pages/prog/www/wigos/GBON.html.

Intergovernmental Oceanographic Commission

35. The 30th session of the IOC Assembly, UNESCO, Paris, 26 June–4 July 2019 approved the Decision IOC-XXX/5.2 **Contribution to the United Nations Framework Convention on Climate Change** (UNFCCC).[25]

36. The Global Ocean Observing System (GOOS) is a collaborative international effort led by the Intergovernmental Oceanographic Commission (UNESCO-IOC). The **GOOS 2030 Strategy**, was accepted at IOC-30, Decision IOC-XXX/7.1.1. The strategy has a broad vision for a fully integrated global ocean observing system that delivers the essential information needed for our sustainable development, safety, wellbeing and prosperity. The strategy details a more focused mission to lead the ocean observing community and create the partnerships to grow GOOS. Eleven Strategic Objectives provide guidance on priorities for the work of GOOS at global and regional levels, and in interactions with national ocean observing activities.[26]

37. The **UN Decade of Ocean Science for Sustainable Development (2021–2030)** will provide a common framework to ensure that ocean science can fully support countries' actions to sustainably manage the oceans and achieve the SDGs, in particular SDG 14. A UN Decade Executive Planning Group is facilitating the international, interdisciplinary discussions across sectors (such as: ocean science and technology; ocean policy and sustainable development; business and industry; NGOs and civil society; donors and foundations) to identify concrete deliverables and partnerships to meet the Decade's six societal objectives: 1). a safe ocean; 2). a sustainable and productive ocean; 3). a transparent and accessible ocean; 4). a clean ocean; 5). a healthy and resilient ocean; 6) a predicted ocean.

38. The **OceanObs'19 Decadal Conference** was the third in a series of decadal conferences that bring the community together to foster the global buy in required to take the observing system forward for the next decade. A **conference statement** is available on the conference website.[27]

Intergovernmental Panel on Climate Change

39. The IPCC approved and accepted the ***Special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*** **(SRCCL)** at its 50th Session held on 2–7 August 2019 in Geneva. The Summary for Policymakers (SPM) was approved by the IPCC plenary on 6 August 2019.[28]

40. The SRCCL is the **first ever comprehensive assessment on the way we use land, from the perspective of climate change, desertification, land degradation and food security**. It provides an updated assessment of the current state of knowledge on these topics since the Fifth Assessment Report and SR1.5. The report is of relevance to all three Rio Conventions (UNFCCC, CBD and UNCCD) and raises important questions on synergies between them in the context of sustainable development.

41. The structure of the Special Report is as follows: Chapter 1: Framing and Context; Chapter 2: Land-Climate Interactions; Chapter 3: Desertification; Chapter 4: Land Degradation; Chapter 5: Food Security; Chapter 6: Interlinkages between desertification, land degradation, food security and GHG fluxes: Synergies, trade-offs and Integrated Response Options; and Chapter 7: Risk management and decision making in relation to sustainable development. The SPM presents the key findings of the SRCCL under four headline statements: A. People, land and climate in a warming world; B. Adaptation and mitigation response options; C. Enabling response options; and D. Action in the near term.

42. The IPCC approved and accepted the ***Special Report on the ocean and cryosphere in a changing climate*** **(SROCC)** at its 51st Session held on 20–23 September 2019, Principality of Monaco. The SPM was approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted at its 51st Session on the 24th September 2019.[29]

43. The SROCC assesses the **latest scientific knowledge about the physical science basis and impacts of climate change on ocean, coastal, polar and mountain ecosystems, and the human communities that depend on them**. Their vulnerabilities as well as adaptation capacities are also evaluated. Options for achieving climate-resilient development pathways are presented as well.

44. The structure of the Special Report is as follows: Chapter 1: Framing and Context of the Report; Chapter 2: High Mountain Areas; Chapter 3: Polar Regions; Chapter 4: Sea Level Rise and Implications for Low Lying Islands, Coasts and Communities; Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities; Chapter 6: Extremes, Abrupt Changes and Managing Risks; Integrative Cross-Chapter Box: Low Lying Islands and Coasts. The Summary for Policy Makers (SPM) presents the key findings of SROCC under three sections: A.

[25] See http://www.ioc-unesco.org/index.php?option=com_oe&task=viewDocumentRecord&docID=24911.
[26] See https://www.goosocean.org/index.php?option=com_oe&task=viewDocumentRecord&docID=24590.
[27] See http://www.oceanobs19.net/statement.
[28] See https://www.ipcc.ch/report/srccl/.
[29] See https://www.ipcc.ch/srocc/home/.

Observed changes and impacts; B. Projected changes and risks; and C. Implementing responses to ocean and cryosphere change.

Ramsar Convention on Wetlands

45. The **Ramsar Convention on Wetlands has taken many steps to ensure the wise use and conservation of wetlands globally**. This has included the development and promotion of guidance and tools for the inventory, assessment and monitoring of change in wetlands with a particular emphasis in recent years on the application of an increasing number of Earth observation or satellite-based remote sensing approaches.[30]

46. Earth observation provides a real means for periodic mapping and monitoring over national, regional and global scales, and in a uniform manner where the same type of data and classification algorithms are used over all areas and over several epochs.[31] The availability and accessibility of Earth observation datasets suitable for addressing the information needs of the Ramsar Convention on Wetlands and wetland practitioners has increased dramatically.

47. The use of **Earth Observation provides Contracting Parties to the Ramsar Convention on Wetlands with new approaches to ensure the wise use and conservation of wetlands at the national and global levels**. Earth observation has many applications including the inventory, assessment and monitoring of wetlands.

48. New capabilities in terms of spatial, temporal and spectral resolution of the data have enabled more efficient and reliable monitoring of the environment over time at global, regional and local scales. These developments provide a myriad of new opportunities for the monitoring and reporting on indicators for the Sustainable Development Goals (SDGs), Nationally Determined Contributions, under the Paris Agreement, and the UN Reducing emissions from deforestation and forest degradation scheme (REDD+), under the UN Framework Convention on Climate Change (UNFCCC).

World Climate Research Programme

49. The WMO/IOC-UNESCO/ISC **World Climate Research Programme (WCRP) has recently published its Strategic Plan 2019–2028**[32] and is working towards an Implementation Plan for the same period. Within this plan the development, collection, analysis, and archiving of multi-variate, multi-scale observations of the climate system is highlighted as a foundation of climate system research. Sustained observations are needed to capture the evolving climate system. Observations are also critical to understand the climate system and to verify and improve climate simulations. We require well-coordinated international observational field and space-based programs, which have access to the most advanced sensors, platforms, and instruments. The development of synergies between disparate observing systems is critical, as is the characterization of bias and uncertainty in instruments and observational products. In addition, we require the co-design of new observations and indicators, sustained and quality-controlled climate system observational records, and the continuous improvement and timely availability of temporally consistent datasets, such as re-analyses. Common data formats, metadata requirements, and citation standards will improve the accessibility of datasets for all researchers.

50. As an example, the **Earth's Energy Imbalance (EEI)** is a topic that cuts across different aspects of WCRP research. Systematic observations are required of the Earth system for the storage of heat in the ocean, land, cryosphere and atmosphere from seasonal to longer time scales, and include the consistent assessment of energy stored in each of these different components of the Earth system. The combined use of observations and models is fundamental to reach this goal, which is about to be further demonstrated in an international community paper under GCOS entitled '**Energy stored in the Earth system: Where does the energy go?**'

51. **For decadal predictions WCRP's Grand Challenge on Near Term Climate Prediction** is working towards routine provision of decadal prediction services. In order to do so ocean observations and analyses such as the Hadley Centre's EN4 database are essential. Comprehensive atmospheric information, including aerosol and greenhouse gas concentrations are needed for atmospheric initialization. **Long-term stable records are needed** so that observations in hindcasts (used for bias correction) are close to those in real time forecasts – this is

[30] Davidson, N.C. & Finlayson, C.M. (2007). Earth Observation for wetland inventory, assessment and monitoring. Aquatic Conservation: Marine and Freshwater Ecosystems, 17, 219–228 and MacKay, H., Finlayson, C.M., Fernández-Prieto, D., Davidson, N., Pritchard, D. & Rebelo, L.-M. (2009). The role of Earth Observation (EO) technologies in supporting implementation of the Ramsar Convention on Wetlands. Journal of Environmental Monitoring 90(7), 2234–2242.

[31] Rebelo, L.M.; Finlayson, C.M.; Strauch, A.; Rosenqvist, A.; Perennou, C.; Tottrup, C.; Hilarides, L.; Paganini, M.; Wielaard, N.; Siegert, F.; Ballhorn, U.; Navratil, P.; Franke, J.; and Davidson, N. (2018). The use of Earth Observation for wetland inventory, assessment and monitoring: An information source for the Ramsar Convention on Wetlands. Ramsar Technical Report No. 10. Gland, Switzerland: Ramsar Convention Secretariat.

[32] See https://www.wcrp-climate.org/wcrp-sp.

an issue for example in sea ice thickness and soil moisture records Some data are just not available such as solar spectral irradiance in near real time for UV solar irradiance.

52. For the longer timescales the **CMIP6 model simulations** used by the IPCC are now progressing, with rapid activity over the next few months as the AR6 timelines approach. Model outputs are now being served by the Earth System Grid Federation (ESGF) from 21 institutions (45 models) and more will be made available over the coming months. **Results from HighResMIP show a significant reduction in some long-standing regional model errors**. **Early results from CMIP6 indicate a higher climate sensitivity than in previous CMIP rounds**. A perspective paper is currently being developed to report on these emergent results The CMIP essential infrastructure is currently delivered by volunteer efforts and individual scientists in often partly/un-funded efforts. A recently approved WMO resolution will look into institutionalizing critical components of the CMIP enterprise.

World Meteorological Organisation

53. Consolidating climate activities – from observation, to research, to services – into a seamless and coherent programme, is a critical strategic priority within the WMO reform. In this context, a major WMO constituent body report, adopted by the eighteenth World Meteorological Congress in June 2019, consolidates **WMO technical commissions and other technical bodies under the umbrella of a holistic Earth System approach**, by establishing two intergovernmental technical commissions on:

(a) **Observations, Infrastructure and Information Systems,** where all WMO observing **activities**, including those related to GCOS observational networks delivering on the ECVs, will be dealt with. Collaboration with GOOS will be through a WMO/IOC Collaborative Board. The Board will also provide advice on common aspects between the WMO and IOC for science, observations, research, data management, services and capacity development.

(b) **Weather, Climate, Water and Related Environmental Services and Applications**. The requirements **determined** through such intergovernmental processes will become international standards and will be governed by the WMO data policy. A **Research Board** will consolidate research requirements of the WCRP, the World Weather Research Programme (WWRP) and Global Atmosphere Watch (GAW), which supports implementation of the Integrated Global Greenhouse Gas Information System (IG3IS). A **Climate Coordination Panel** (CCP) has also been established to serve as an interface with IPCC, UNFCCC and international partners of the Global Framework for Climate Services (GFCS) and to provide an overall GFCS governance mechanism. The CCP will ensure coordination across all the above entities involving WMO contributions to the provision of climate-related policy- and decision-supporting climate information and services.

54. The **WMO report on The Global Climate in 2015–2019** was released in September to inform the United Nations Secretary-General's Climate Action Summit.[33] The latest analysis of observations from the WMO GAW shows that globally averaged surface concentrations calculated from this in-situ network for CO_2, CH_4 and N_2O reached new highs. The growth rates of the CO_2, CH_4 and N_2O concentrations in the atmosphere averaged over the 2015–2017 period for which data have been completed and processed are each about 20% higher than those over 2011–2015. Preliminary analysis shows that in 2018 the CO_2 annual mean concentration at Mauna Loa Observatory, Hawaii, reached 408.52 ppm and the increase from 2017 to 2018 was 1.97 ppm. In regard to global temperatures, the five-year period 2015–2019 is likely to be the warmest of any equivalent period on record, with all five years being the top 5 warmest years on record. The year 2016 remains the warmest year on record due to an additional heating associated with the strong El Niño 2015/2016.

55. The greenhouse gas bulletin, based on global observations through 2018, and a provisional annual **statement on the State of the global Climate in 2019** will be submitted to SBSTA 51.

56. In response to the **key findings and recommendations of the mid-term review of the GFCS**, the 18th World Meteorological Congress through resolution 21 decided:

(a) To dissolve the Intergovernmental Board on Climate Services;

(b) To adopt the CCP as the oversight and implementation mechanism for the GFCS, including WMO contributions to the GFCS;

(c) To continue the GFCS Partner Advisory Committee as appropriate, under the remit of CCP;

(d) To reaffirm the GFCS priorities of agriculture and food security, water, health, energy and disaster risk reduction, taking into account the cross-cutting nature of urban dimension;

(e) To adopt the following priority GFCS tasks for the eighteenth financial period, namely: (i) partnership and inclusion, (ii) technical coordination support, (iii) monitoring and review, (iv) resource mobilization.

[33] See https://public.wmo.int/en/media/press-release/global-climate-2015-2019-climate-change-accelerates.

57. **The GFCS is preparing a "State of Climate Services" report,** documenting the current status of climate information and associated services in relation to Parties priorities identified in their Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs). The report will be launched at COP 25 to support adaptation and resilience in climate-sensitive sectors more broadly, and in response to Decision 11/CMA.1.

58. **The GFCS has been supporting countries to develop National Frameworks for Climate Services (NFCS)**, promoting the routine use of climate information services to guide and inform adaptation planning at the national level, sectoral, and local level. As of August 2019, 46 WMO Members had established or were in the process of establishing NFCSs.[34]

59. WMO is organizing, through an agreement with the Green Climate Fund (GCF), a **series of workshops in five countries Saint Lucia, Congo DRC, Cabo Verde, Cambodia and Paraguay to articulate the climate science basis of NAPs and GCF and other funded projects and activities**. This project has provided an opportunity to test the methodologies for articulating the climate science basis for climate action and enhancing the confidence at national level concerning the use of climate information in project planning. These workshops also provide expert input from the WMO expert bodies, NMHSs, and regional and global centers. An online platform for climate information developed by the Swedish Meteorological and Hydrological Institute (SMHI) is made available to national stakeholders in each country. The climate science basis initiative responds to Decisions 11/CMA.1 and 8/CP.24. Outcomes of this initiative will be reported to COP 25 and shared in a policy document.

60. The GFCS, in collaboration with the United Nations Institute for Training and Research (UNITAR), has developed an **E-course on "Integrating climate risk information into NAPs**" launching 2019.

61. Resolution 74 of the eighteenth World Meteorological Congress (Cg-18) approved the **Country Support Initiative (CSI)**, recognised by SBSTA 50.[35] This resolution decided to pursue the **establishment of the Alliance for Hydromet Development**, jointly with the World Bank and in collaboration with a larger group of international development partners, for increased and more effective and sustainable development assistance. The Alliance will be launched at COP 25. It will bring together major development and climate finance partners. The Alliance will be based on a joint declaration that will have as one of its commitments to regularly report on "hydromet gaps" based on objective assessments of NMHS capacity and performance.

62. The Eighteen World Meteorological Congress (Cg-18, 2019) approved the further development of the **Global Cryosphere Watch** (GCW)[36] as a cross cutting mechanism across all WMO programmes to respond to the urgency of making available consistent and usable cryosphere data, information, and products, supporting Members in delivering user required services on water resource management, climate services, climate science, weather forecasting, and improved understanding of natural hazards and risks. Resolution 50 (Cg-18) approved the pre-operational phase of GCW, with GCW expected to be fully operational by 2024, with a special focus on strengthening the links between cryosphere and operational hydrology activities.

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[34] See https://gfcs.wmo.int/NFCS_status.
[35] FCCC/SBSTA/2019/2 paragraph 60.
[36] See https://globalcryospherewatch.org/.